29 June 2022

Trading Conduct Report

Market Monitoring Weekly Report

1. Overview for the week of 19 to 25 June

1.1. Wholesale spot prices this week appear to be consistent with supply and demand conditions.

2. Spot Prices

2.1. This report monitors underlying wholesale price drivers to assess whether there are trading periods that require further analysis for the purpose of considering potential non-compliance with the trading conduct rule. In addition to general monitoring, we also single out unusually high-priced individual trading periods for further analysis by identifying when wholesale electricity spot prices at Benmore and/or Otahuhu nodes exceed their historical 90th percentiles. These historically high-priced trading periods are marked out by vertical lines in the majority of figures in this report.

2.2. Wholesale electricity spot prices across all nodes between 19 and 25 June averaged $207.13/MWh with 95 per cent of prices falling between $11.75/MWh and $277.86/MWh.

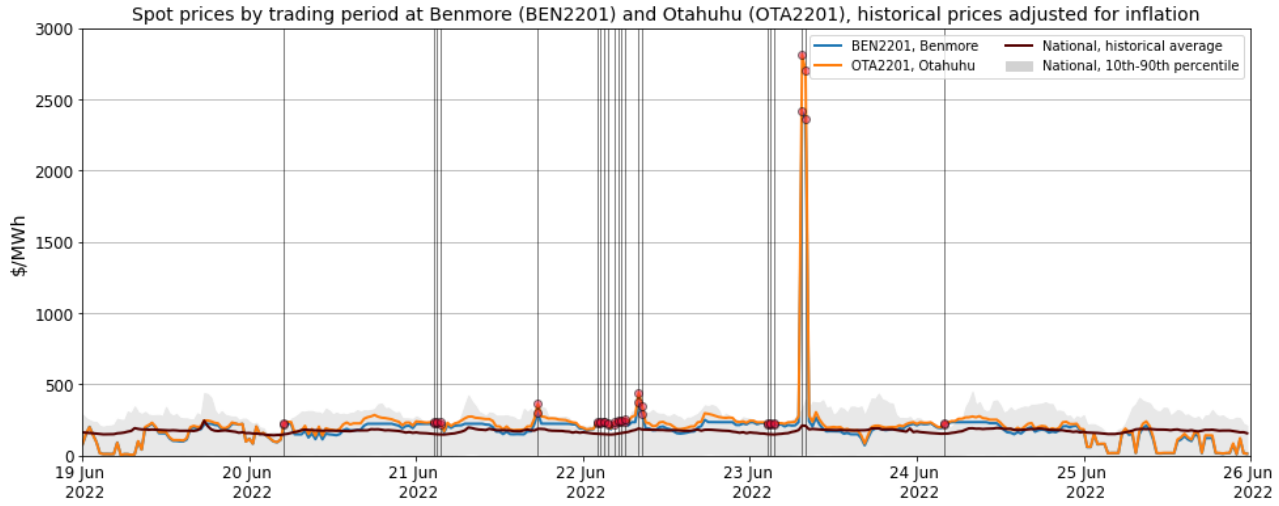
2.3. Figure 1 shows spot prices from the past week at Benmore and Otahuhu alongside their historic mean and historic 10^{th}-90^{th} percentiles adjusted for inflation.

2.4. Weekday spot prices were relatively high this week though showed less volatility than the previous week.

2.5. Transpower grid emergency reports leading up to a grid emergency notice being released on the morning of Thursday 23 June indicated that there were insufficient generation offers to meet demand between 7:54am and 9:00am. This resulted in participants being requested to decrease demand by using controllable load and increase distributed generation. The lack of sufficient generation offers led to a price spike of over $2,500/MWh at trading periods 16 and 17 on 23 June as seen in Figure 1.

2.6. As with previous weeks, spot prices most commonly tended to rise above their 90^{th} historical percentiles during off peak periods.

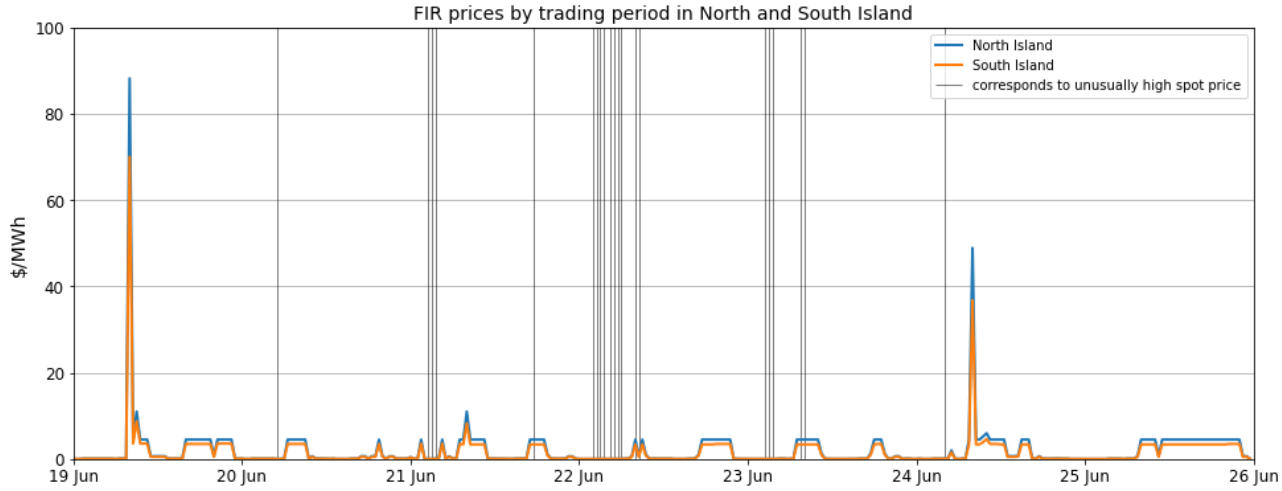
Figure 1: Wholesale Spot Prices



3. Reserve Prices

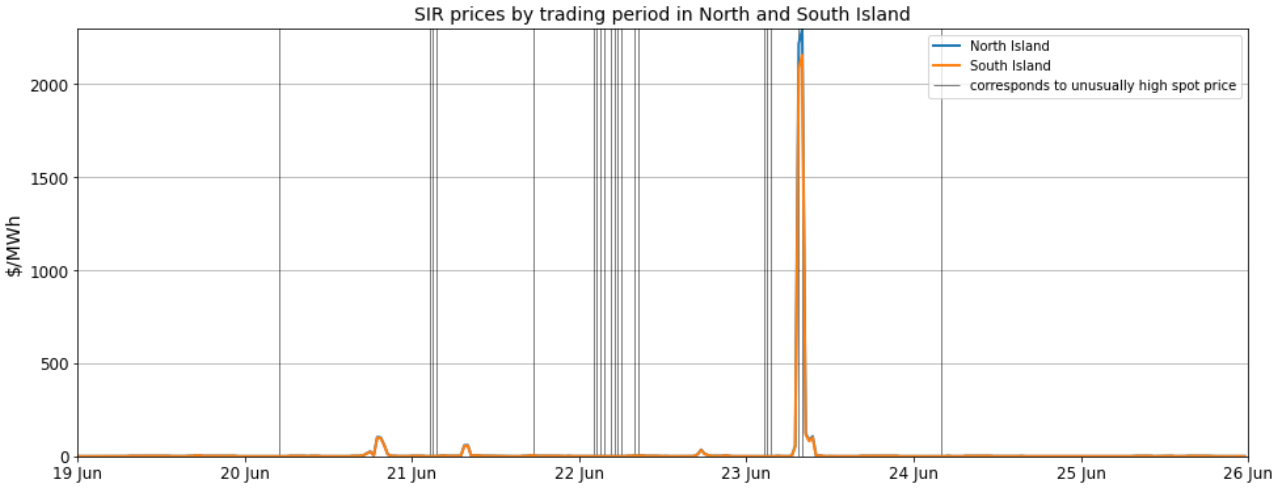
3.1. Fast instantaneous reserves (FIR) prices for the North and South Island are shown below in Figure 2. FIR prices this week saw spikes of up to $90/MWh with remaining prices falling within historical bounds at below $20/MWh. These spikes may be due to a mixture of factors including fewer reserve offers due to some thermal stations not running and possible co-optimisation by the system operator.

Figure 2: FIR prices by trading period and Island



3.2. Sustained instantaneous reserves (SIR) prices for the North and South Island are shown below in Figure 3. SIR reserve prices this week spiked to over $2000/MWh on the morning of 23 June when there were insufficient generation offers to meet demand. The insufficient generation offers and high demand meant more reserves were dispatched than usual resulting in the spike in reserve prices. Remaining SIR prices mostly fell within historical bounds with other spikes due to possible co-optimisation by the system operator.

Figure 3: SIR prices by trading period and Island



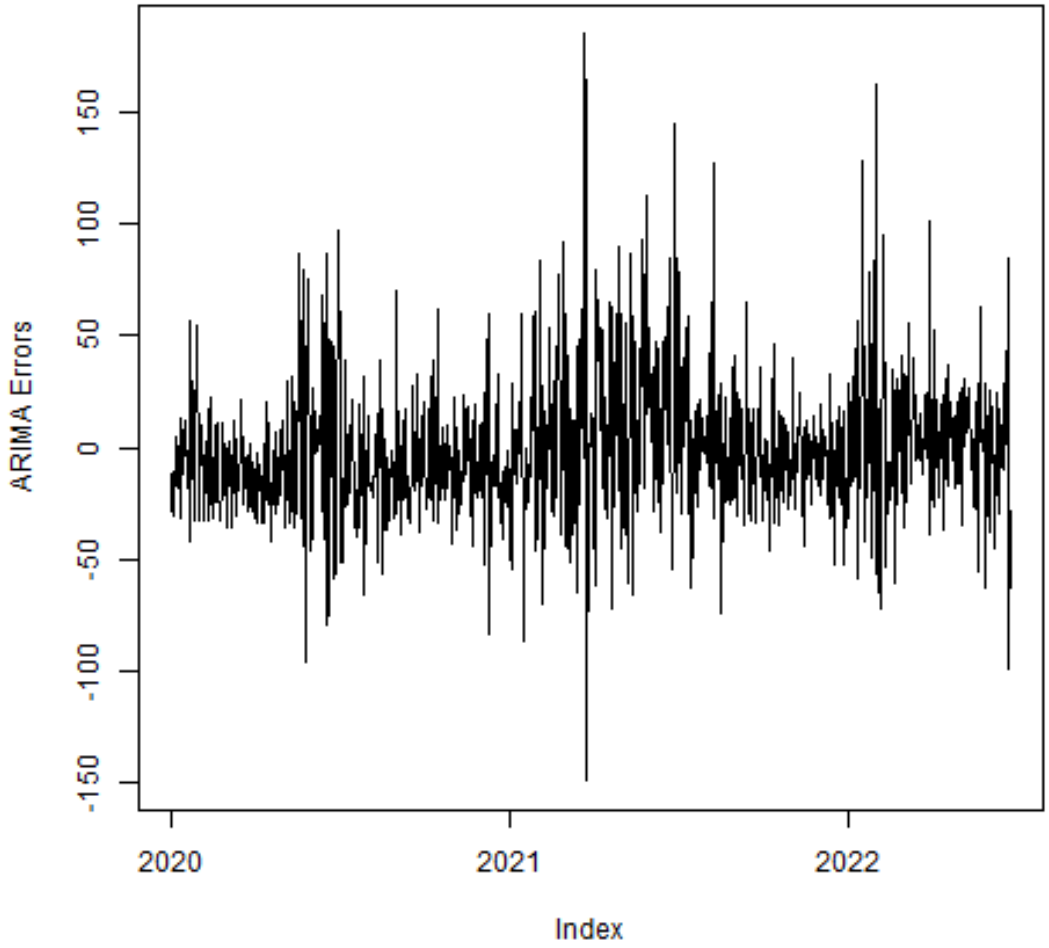
4. Regression Residuals

4.1. The Authority's monitoring team has developed two regression models of the spot price. The residuals show how close the predicted prices were to actual prices. Large residuals may indicate that prices do not reflect underlying supply and demand conditions. Details on the regression model and residuals can be found in Appendix A[1] on the trading conduct webpage.

4.2. Figure 4 shows the residuals of autoregressive moving average (ARMA) errors from the daily model. Daily residuals this week suggest that prices appear to be largely aligned with market conditions. Residuals were mostly flat at the beginning of the week before rising in the middle of the week when the insufficient generation grid notices were released.

[1] https://www.ea.govt.nz/assets/dms-assets/29/Appendix-A-Regression-Analysis.pdf

Figure 4: Residual plot of estimated daily average spot price YTD

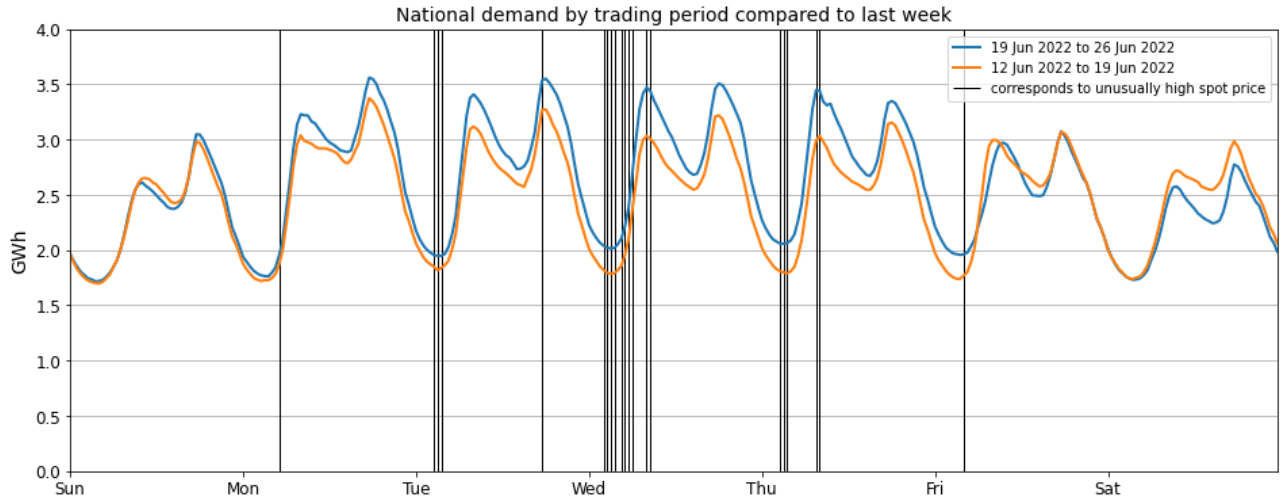


5. Demand

5.1. Grid demand continues to follow seasonal trends, increasing when temperatures decrease. Figure 5 shows this week's (19-25 June) national grid demand against national grid demand from the previous week (12-18 June). Weekday grid demand this week has increased compared to the previous week, corresponding to a decrease in national temperatures as seen in Figure 6.

5.2. The 23 June grid emergency notice was resolved by participants decreasing controllable load e.g. ripple controlled hot water systems, which kept grid demand below 7,000 MW. The moment when controllable load was restored can be seen by a small secondary bump in morning load on Thursday in Figure 5.

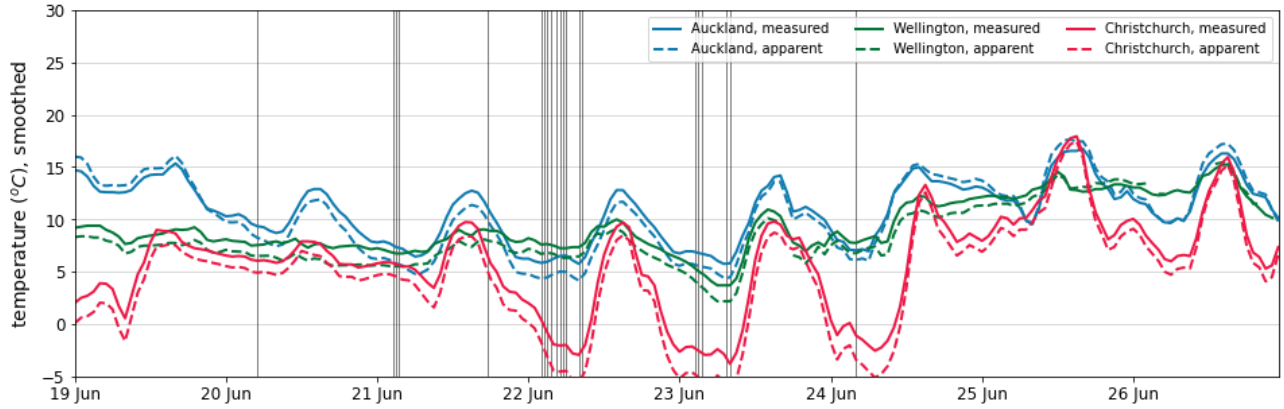
Figure 5: National demand by trading period compared to the previous week



5.3. Figure 6 shows hourly temperature at main population centres. The measured temperature is the recorded temperature, while the apparent temperature adjusts for factors like wind speed and humidity to estimate how cold it feels.

5.4. Low temperatures were likely the main reason for increased demand this week with temperatures up to 24 June averaging below 10° degrees.

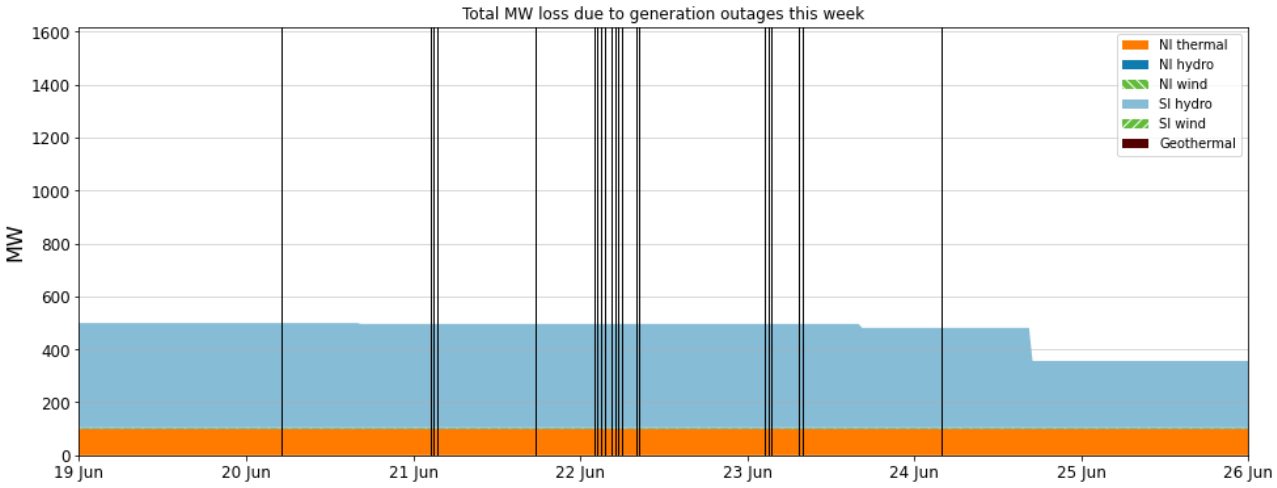
Figure 6: Temperatures across main centres



6. Outages

6.1. Figure 7 shows total generation capacity lost due to outages. Outages continue to be significantly lower than previous weeks with total capacity lost this week at around ~500 MW. Current outages compose of one thermal outage at Stratford Peaker 2 and some hydro outages. Generally, fewer outages help to keep spot prices within historical bounds.

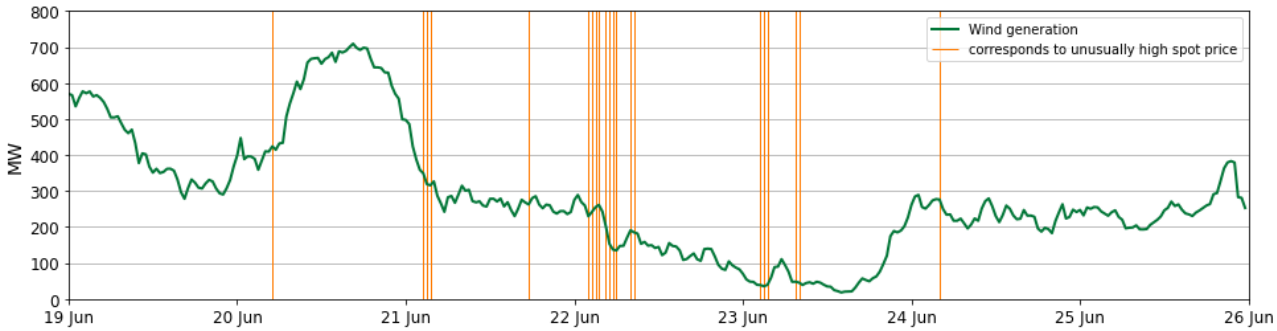
Figure 7: Total MW loss due to generation outages



7. Generation

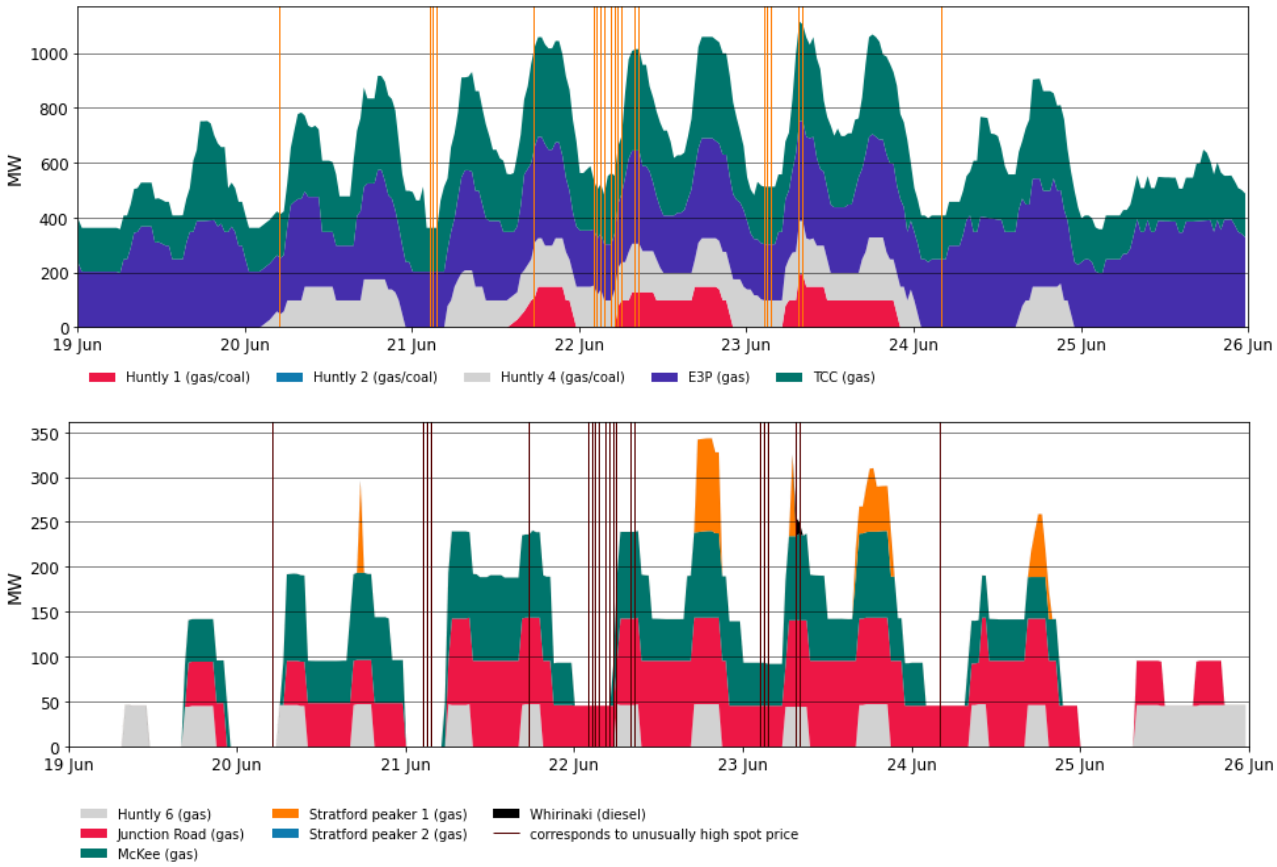
7.1. Figure 8 shows wind generation from the past week. Wind generation was strong at the beginning of the week at between 300 MW and 700 MW before dropping from 21 June onwards, staying below 300 MW for the remainder of the week. Low wind generation was one of the main reasons for high spot prices this week, with Transpower's insufficient generation notices issued when wind generation was less than 50 MW.

Figure 8: Wind Generation



7.2. Figure 9 shows generation at thermal and thermal peaker plants from the past week. Due to low wind generation thermal generation was high this week, totalling between around ~400 MW and ~1,100 MW when wind generation dropped to below 300 MW. Thermal generation reached its peak on the morning of 23 June at trading periods 16 and 17 with Huntly 1 generating at its maximum capacity. Thermal peakers also ran hard, with Whirinaki being dispatched briefly on the morning of 23 June at trading period 16. The high thermal generation would have been one of the main contributors to high spot prices this week.

Figure 9: Thermal Generation



8. Storage/Fuel Supply

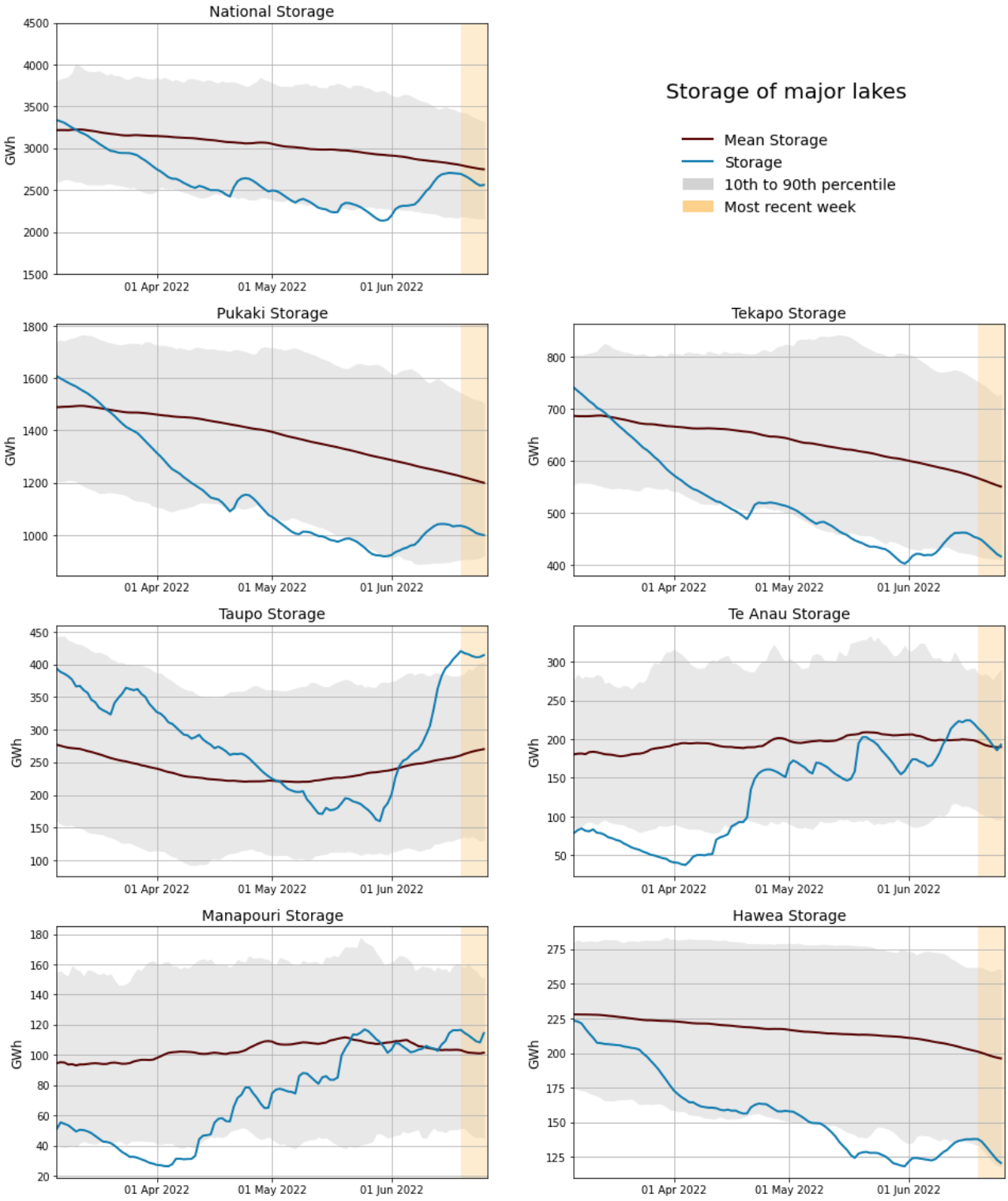
8.1. Figure 10 shows total controlled national hydro storage as well as the storage of major catchment lakes including their historical mean and 10th to 90th percentiles.

8.2. Total national hydro storage on 25 June was 92 per cent of historical mean.

8.3. Of the major catchments Lake Taupo storage is above its 90th percentile, Lakes Manapouri and Te Anau are around their historical mean and remaining lakes are around their 10th percentiles.

8.4. While increased hydro storage has increased the amount of offered hydro generation the imbalance in storage between islands means the ratio of offers in different price tranches for hydro generation is still relatively similar to when hydro storage was lower, preserving the steepness of current offer curves.

Figure 10: Hydro Storage



9. Price versus estimated costs

9.1. In a competitive market, prices should be close to (but not necessarily at) the short run marginal cost (SRMC) of the marginal generator (where SRMC includes opportunity cost).

9.2. The SRMC (excluding opportunity cost of storage) for thermal fuels can be estimated using gas and coal prices, and the average heat rates for each thermal unit. Note that the SRMC calculations include the carbon price, an estimate of operational and maintenance costs, and transport for coal. Figure 11 shows an estimate of thermal SRMCs as a monthly

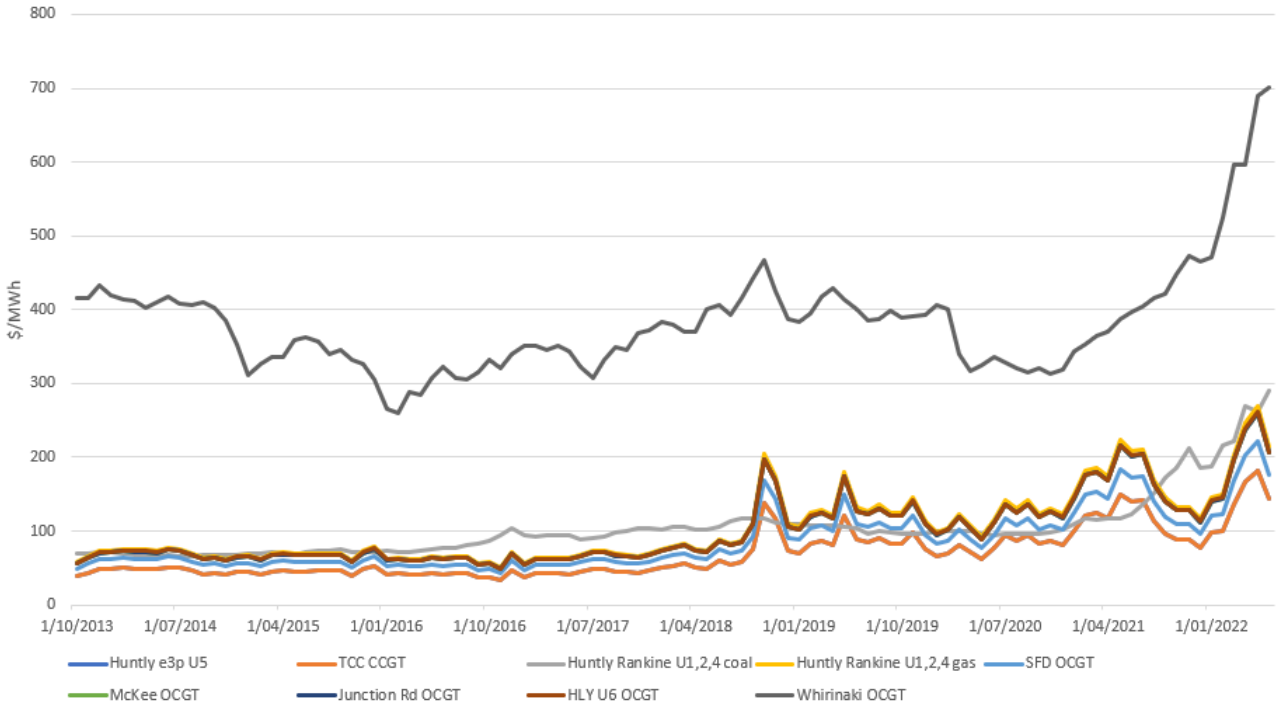
average up to 1 June 2022. The SRMC of all plants has increased sharply since the beginning of 2022.

9.3. The SRMC of coal and diesel have both increased due to global supply and demand conditions. As well as supply disruptions caused by Covid, the Russian-Ukraine conflict has increased the premium on all international coal due to sanctions placed on Russia. The conflict has pushed recent coal prices to a historic high of $510/tonne. The increase in diesel and coal prices has put the latest SRMC of Whirinaki and coal fuelled Huntly generation to well above $700/MWh and $300/MWh respectively.

9.4. SRMCs of gas run thermal plants have decreased with the outlook for gas supply in the second half of 2022 looking increasingly positive.

9.5. More information on how the SRMC of thermal plants is calculated can be found in Appendix C[2] on the trading conduct webpage.

Figure 11: Estimated monthly SRMC for thermal fuels



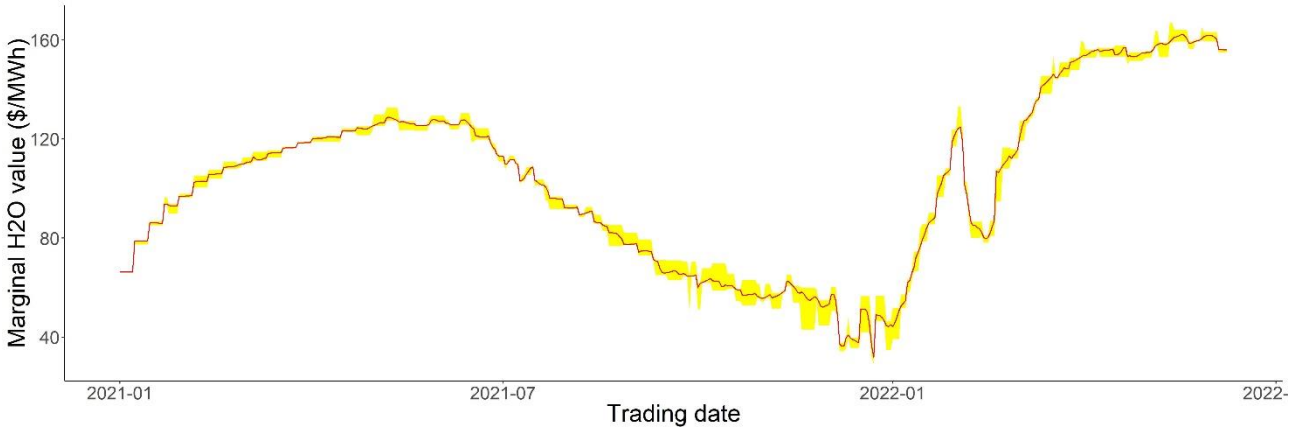
10. JADE Water values

10.1. The JADE[3] model gives a consistent measure of the opportunity cost of water, by seeking to minimise the expected fuel cost of thermal generation and the value of lost load and provides an estimate of water values at a range of storage levels. Figure 12 shows the national water values to 8 June 2022 using values obtained from JADE. The outputs from JADE closest to actual storage levels are shown as the yellow water value range. These values are used to estimate marginal water value at the actual storage level. More details on how water values are calculated can be found in Appendix B[4] on the trading conduct webpage.

[2] https://www.ea.govt.nz/assets/dms-assets/30/Appendix-C-Calculating-thermal-SRMCs.pdf
[3] JADE (Just Another DOASA Environment) is an implementation of the Stochastic Dual Dynamic Programming (SDDP) algorithm of Pereira and Pinto. JADE was developed by researchers at the Electric Power Optimisation Centre (EPOC) for the New Zealand electricity market.
[4] https://www.ea.govt.nz/assets/dms-assets/29/Appendix-B-JADE-water-value-model.pdf

10.2. In general, marginal water values have increased when total national hydro storage has decreased. For the last two months water values have been gradually increasing as hydro storage has declined and despite the recent bump in hydro storage water values continue to hover around ~$150/MWh.

Figure 12: Water Values



11. Offer Behaviour

11.1. Figure 13 shows this week's daily offer stacks, adjusted to take into account wind generation, transmission constraints, reserves and frequency keeping.[5] The black line shows cleared energy, indicating the range of the average final price.

11.2. High thermal and hydro generation opportunity costs as detailed above continue to drive a steep offer curve.

11.3. Low wind generation decreased the amount of low priced $0-50/MWh offers this week while increased demand increased the amount of dispatched generation required. As a result, prices quickly moved up the offer curve during peak periods this week.

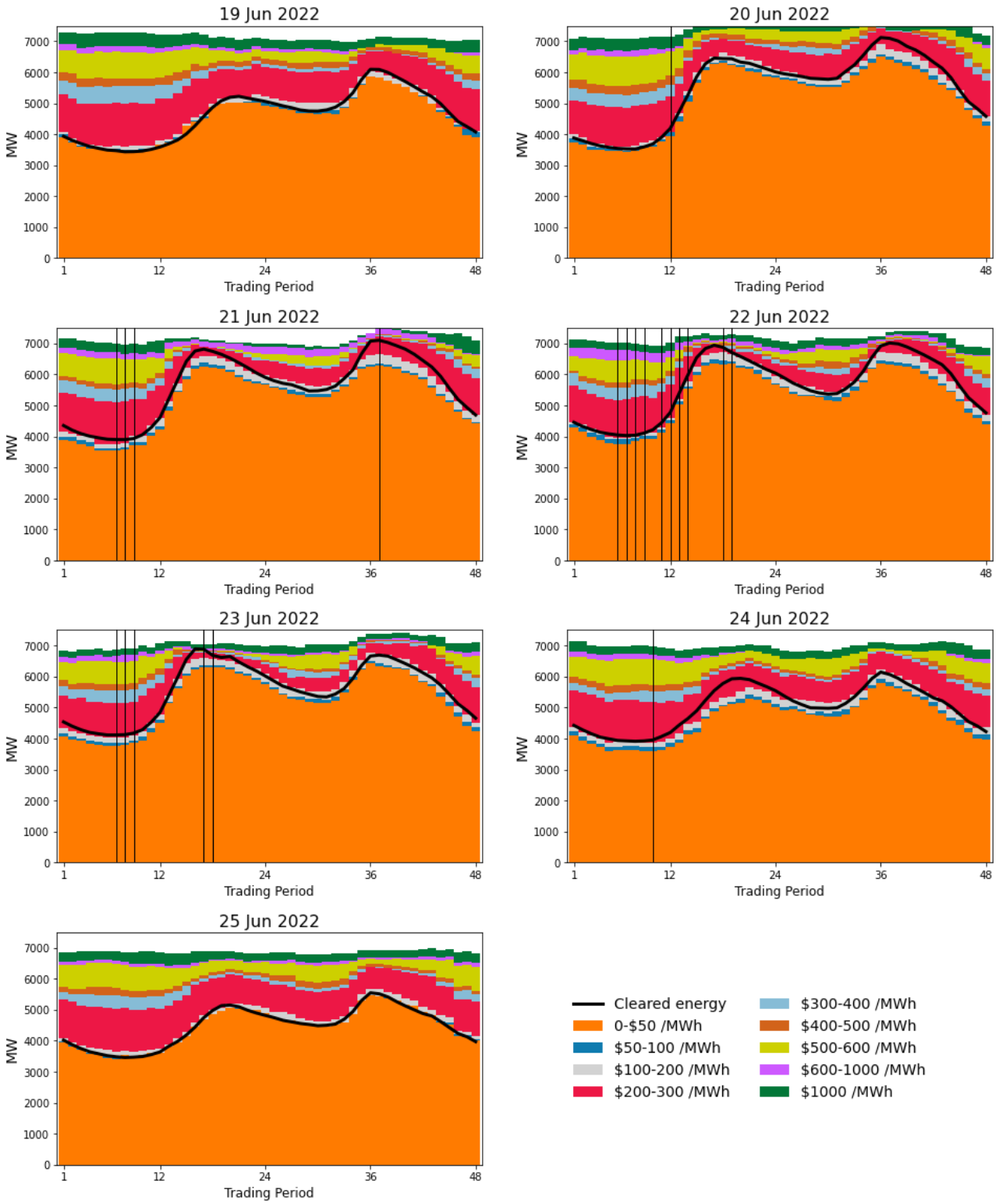
11.4. The relatively high amount of thermal generation running during off-peak periods and relatively high amount of demand pushing prices up a steep offer curve also resulted in higher than historically expected prices during off peak periods.

11.5. A lack of sufficient generation offers meant prices reached the $1,000/MWh+ band on the morning of 23 June though decreased controllable load helped to prevent prices from increasing further.

11.6. The pre-dispatch offers in the short term lead up to high prices showed no changes that would suggest generators were trying to take advantage of market conditions.

[5] The offer stacks show all offers bid into the market (where wind offers are truncated at their actual generation and excluding generation capacity cleared for reserves) in price bands and plots the cleared quantity against these.

Figure 13: Daily offer stack



12. Ongoing Work in Trading Conduct

12.1. This week prices appeared to be consistent with supply and demand conditions.

12.2. Further analysis is being done on the trading periods in Table 1 as indicated.

Table 1: Trading periods identified for further analysis

Date	TP	Status	Notes
19/02/22-24/02/22	Several	Compliance enquiries in progress	After reviewing information received from Genesis regarding offers from Tekapo B while Lake Tekapo was spilling, this case has been passed to compliance to assess if the offers were compliant with trading conduct rules.
19/02/22-21/02/22	Several	Resolved	High reserve prices were due to the HVDC outage, which increased reserve requirement in South Island, combined with less reserves available in the South Island due to low lake levels at Manapouri.